

## REGISTRY

# National Registry on Cardiac Electrophysiology (2012)<sup>☆</sup>



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**Abstract** Based on a survey sent to Portuguese centers that perform diagnostic and interventional electrophysiology and/or implantable cardioverter-defibrillator (ICD) implantations, the authors analyze the number and type of procedures performed during 2012 and compare these data with previous years.

In 2012, a total of 2561 diagnostic electrophysiologic studies were performed, which were followed by ablation in 2017 cases, representing a steady situation compared with the previous year. There was a 12% increase in the number of ablation procedures for atrial fibrillation, making it for the first time the most frequent indication for ablation, overtaking atrioventricular nodal reentrant tachycardia.

The total number of first ICD implantations was 1048 (around 100 per million population), of which 375 were cardiac resynchronization devices (BiV ICDs). This represents a slight decrease (3.3%) in the total number of new implants, with a relative increase of 10% in the number of BiV ICDs compared to the previous year. However, there was a considerable increase in the number of ICD generator replacements, resulting in an overall increase of 3.5% in implantations performed in 2012.

Some comments are made regarding developments in this activity and its current status, and on some factors that may influence the dynamics of this area of interventional cardiology.

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## PALAVRAS-CHAVE

Eletrofisiologia cardíaca;  
Ablação por cateter;  
Cardioversor-desfibrilhador implantável;  
Ressincronização cardíaca

## Registo nacional de eletrofisiologia cardíaca (2012)

**Resumo** Os autores analisam o número e tipo de procedimentos efetuados durante o ano de 2012 com base em inquéritos enviado aos centros nacionais que durante este ano praticaram eletrofisiologia diagnóstica e de intervenção e/ou implantaram cardioversores-desfibrilhadores (CDI), e comparam estes dados com os de anos anteriores. Em 2012 foram efetuados 2.561 estudos eletrofisiológicos diagnósticos, seguidos de ablação em 2.017 dos casos, o que representa uma estabilização comparativamente ao ano anterior. Registou-se um aumento de 12% no número de ablações de fibrilhação auricular, que passou a representar a indicação mais frequente para ablação, ultrapassando a taquicardia por reentrada nodal auriculoventricular.

O número total de primeiras implantações de CDI foi de 1.048 (cerca de 100/milhão de habitantes), sendo que, destes, 375 eram CDI com ressincronização ventricular (CDI BIV). Estes dados traduzem um ligeiro decréscimo (3,3%) do número de primeiras implantações, com um aumento relativo de 10% no número de CDI BIV face ao ano anterior. No entanto, verificou-se um crescimento muito significativo no número de substituições de geradores de CDI, de que resultou um acréscimo de 3,5% no total de implantações efetuadas em 2012. São feitas algumas considerações acerca da evolução e estado atual desta atividade hospitalar e sobre alguns fatores que poderão influenciar a dinâmica verificada nesta área da cardiologia de intervenção. © 2014 Sociedade Portuguesa de Cardiologia. Publicado por Elsevier España, S.L.U. Todos os direitos reservados.

## Introduction

The National Registry on Cardiac Electrophysiology is an annual registry maintained by the Portuguese Association of Arrhythmology, Pacing and Electrophysiology (APAPE) and the Portuguese Institute of Cardiac Rhythm (IPRC) that, in collaboration with all national electrophysiology centers (public and private), records data on invasive electrophysiology (electrophysiology studies and catheter ablations) and implantation of implantable cardioverter-defibrillators (ICDs) in Portugal.

This is an area of considerable dynamism in cardiology in terms of technical advances, clinical implementation and updating of international guidelines. It is therefore important to assess not only the scientific aspects of the activity but also the number of procedures performed, to provide an overall picture of the situation in Portugal with regard to the number of participating centers and their volume of activity and the number and type of procedures performed, as well as development over time. These data are also important in determining the training capabilities of the different centers in order to provide the national health authorities with information on the activity of this hospital sector.

The Registry is also used for comparing Portugal with other countries, particularly as it forms the basis for Portuguese participation in the European Heart Rhythm Association (EHRA) White Book,<sup>1</sup> an annual publication that presents statistics on invasive electrophysiology in European Society of Cardiology member countries.

This article presents the data for Portugal for 2012.

## Methods

Although most centers in Portugal have computerized records, it has not been possible to achieve centralized data collection for the Registry, the main reason being

the different data formats used by the various centers. Thus, as in previous years, data were collected following personal contact with the heads of the pacing and electrophysiology laboratories, and forms were sent on which the required information was to be entered, which were submitted by email in most cases. This information was used to assess the number and type of diagnostic electrophysiology studies (EPS) and ablation procedures performed, types of arrhythmia treated by ablation and number and type of ICDs implanted or replaced, including biventricular cardiac resynchronization devices (BiV ICDs).

## Results

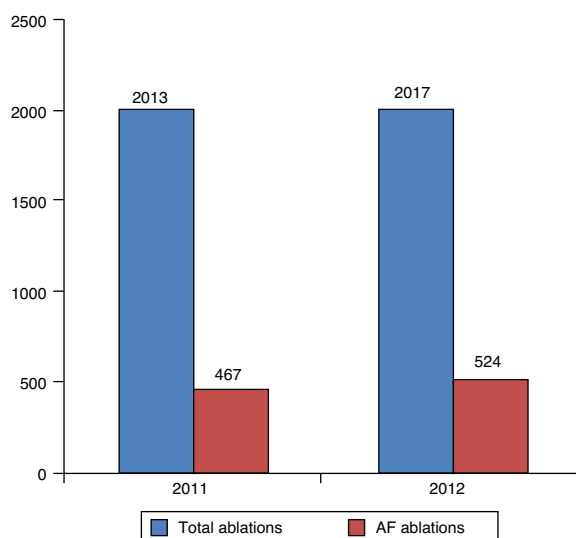
Responses were obtained from all public and private centers. In 2012 the number of centers performing EPS and/or ICD implantation remained at 27, of which 20 were public hospitals and seven private institutions.

## Electrophysiologic studies and catheter ablations

There were 18 centers performing EPS in 2012, of which 10 were public (three in the north of the country, one in the central region, and six in the south) and eight private (one in the north, two in the central region, and five in the south). One public hospital (Faro), which had begun operating in this field in 2011, suspended activity in 2012, while one private center (Idealmed, Unidade Hospitalar de Coimbra) began performing EPS in 2012.

The total number of diagnostic EPS was 2561, around 1% more than in 2011, followed by ablation in 2017 of cases, a similar number of ablation procedures to the previous year (Figures 1 and 2).

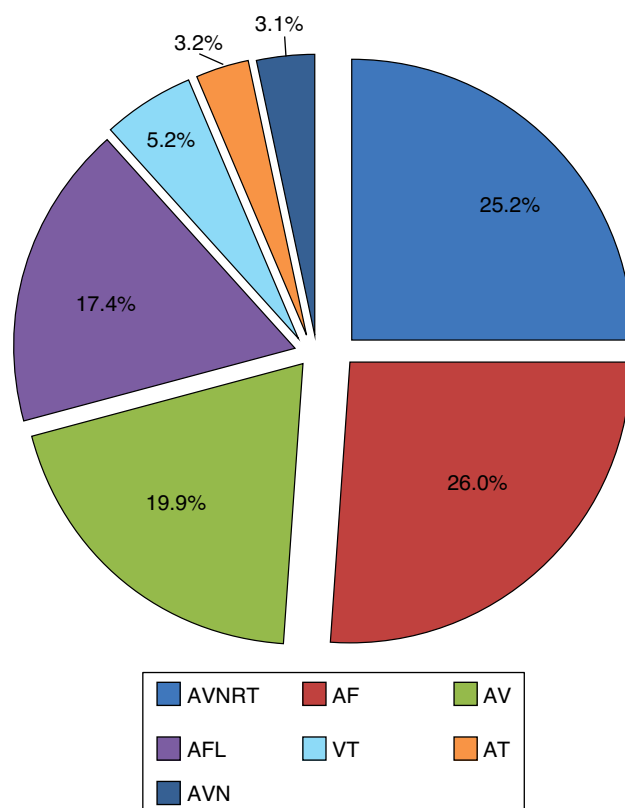
With regard to the types of arrhythmia treated, there was a considerable increase in ablation of atrial fibrillation (AF) (Figure 1), rising from 467 cases in 2011 to 524 in 2012,



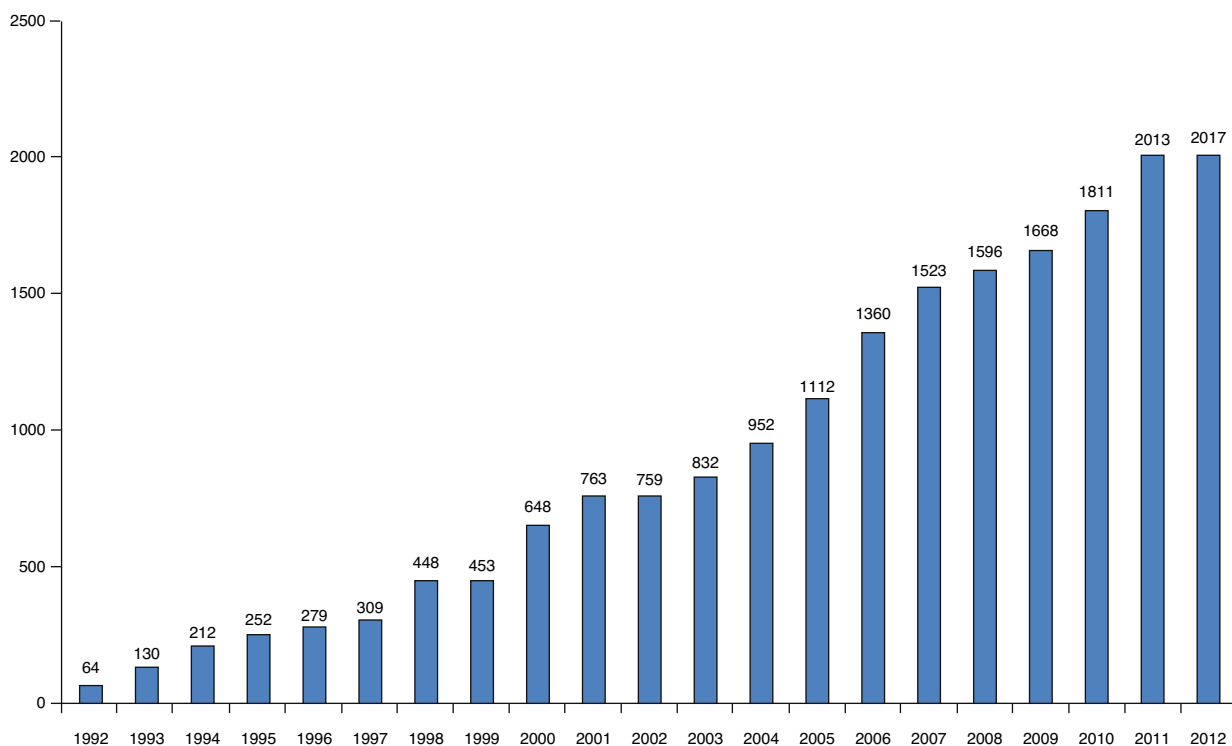
**Figure 1** Total number of ablations and of atrial fibrillation ablations performed in Portugal in 2011 and 2012. AF: atrial fibrillation.

an increase of 12.2%, making AF the arrhythmia most often treated by catheter ablation. However, AF ablation was performed in only 11 of the 18 centers, of which five were private; in four centers the number of AF ablations was <10 per year, while the two centers with the greatest volume of activity performed >100 procedures per year.

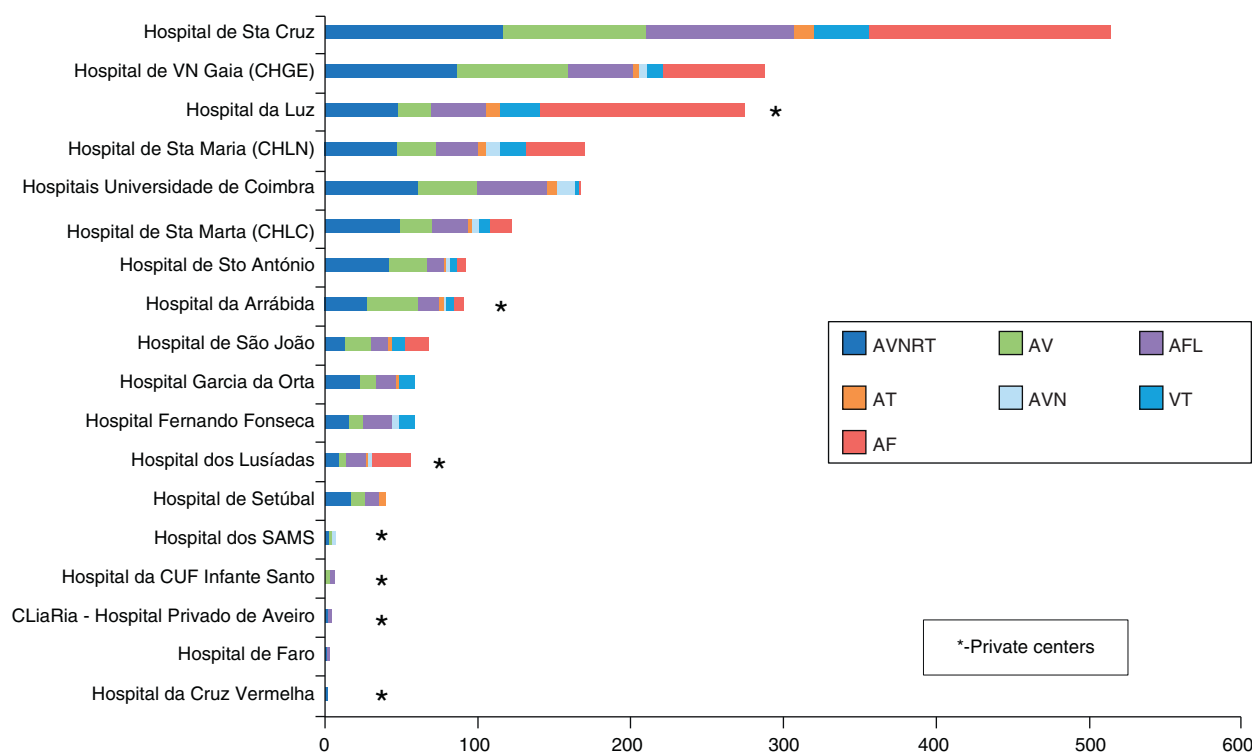
Figure 3 shows the numbers and types of ablation procedures performed in 2012. AF accounted for 26% of interventions, for the first time exceeding atrioventricular nodal reentrant tachycardia (25%), followed by



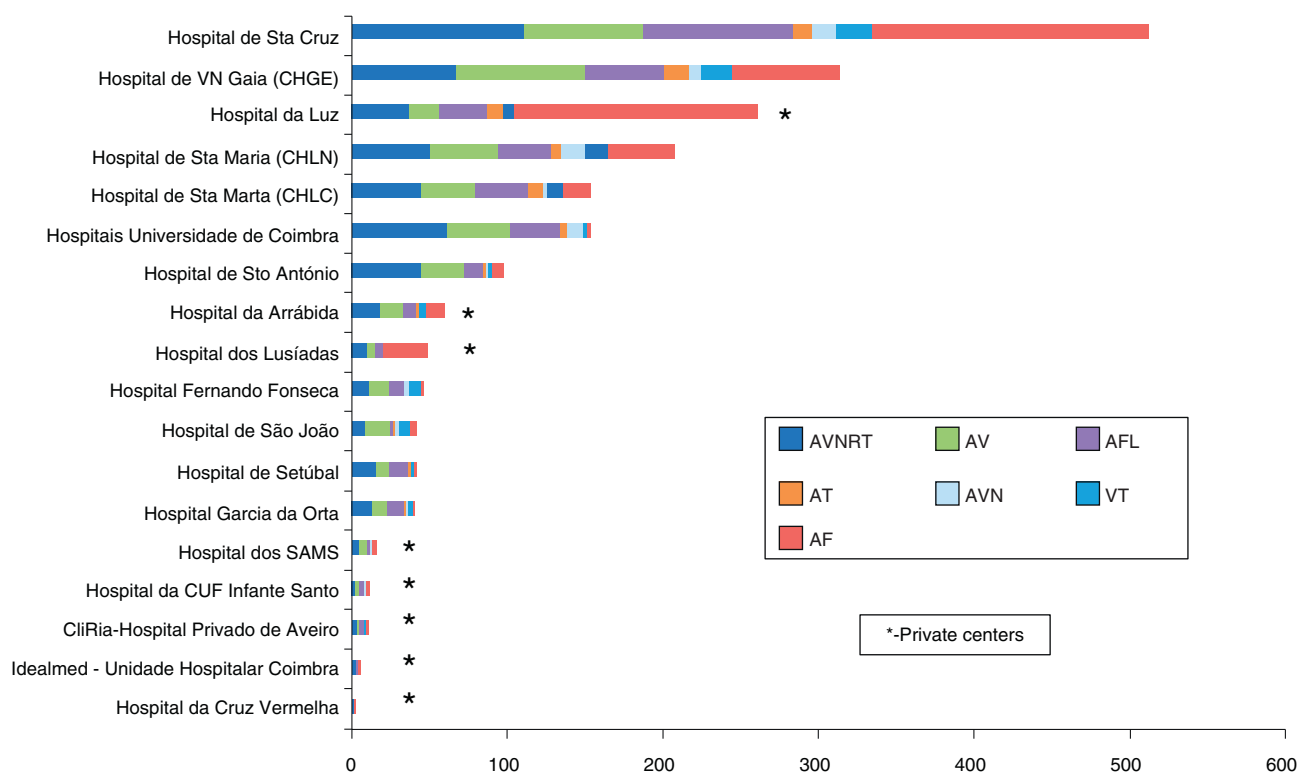
**Figure 3** Indications for ablation in Portugal in 2012. AF: atrial fibrillation; AFL: atrial flutter; AT: atrial tachycardia; AV: atrioventricular accessory pathways; AVN: atrioventricular node; AVNRT: atrioventricular nodal reentrant tachycardia; VT: ventricular tachycardia.



**Figure 2** Total number of ablations per year from 1992 to 2012.



**Figure 4** Number of ablation procedures by center in 2011. AF: atrial fibrillation; AFL: atrial flutter; AT: atrial tachycardia; AV: atrioventricular accessory pathways; AVN: atrioventricular node; AVNRT: atrioventricular nodal reentrant tachycardia; VT: ventricular tachycardia.



**Figure 5** Number of ablation procedures by center in 2012. AF: atrial fibrillation; AFL: atrial flutter; AT: atrial tachycardia; AV: atrioventricular accessory pathways; AVN: atrioventricular node; AVNRT: atrioventricular nodal reentrant tachycardia; VT: ventricular tachycardia.

atrioventricular accessory pathways (20%) and atrial flutter (17.4%), similar percentages to previous years.<sup>2</sup> Ablation of ventricular arrhythmia and atrial tachycardia remained uncommon indications ( $\leq 5\%$  each), despite technical advances in the procedure and improved success rates with the use of three-dimensional mapping systems. Atrio-ventricular junction ablation continued to be the least frequent intervention (3.1%), although this represents an increase of 1%, probably due to its indication for patients with permanent AF treated by ventricular resynchronization therapy for heart failure.

Figures 4 and 5 show the numbers and types of ablation procedures performed in 2011 and 2012 in the different centers. Only six centers exceeded 100 ablations per year, but of these, two performed 200–300 procedures per year and two exceeded 300. These figures indicate an increase in the range of options in Portugal to acquire the training required for subspecialty cardiac electrophysiology according to international standards, especially in the area of clinical electrophysiology and complex arrhythmias, including AF, non-isthmus-dependent atrial flutter, ventricular tachycardia, sinus node modification, ablations in patients with congenital heart disease, and epicardial approaches.<sup>3–5</sup>

### Implantable cardioverter-defibrillators

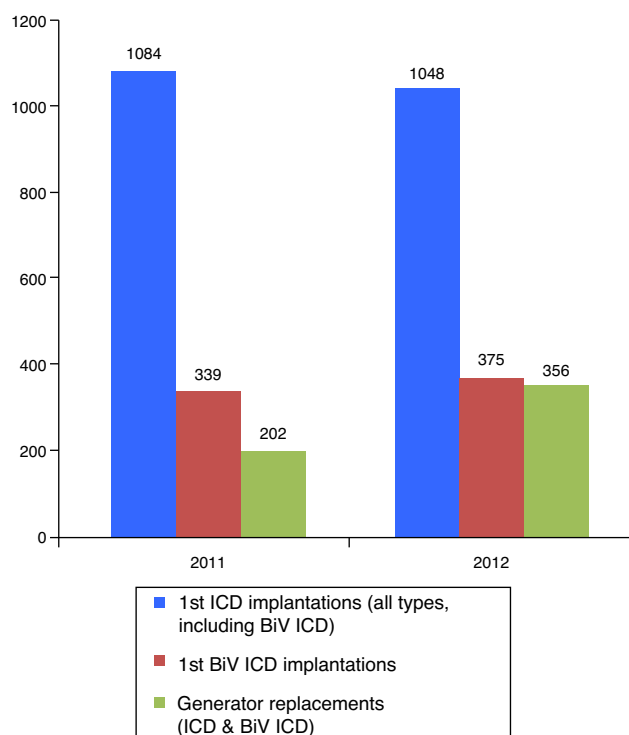
There were 26 centers implanting ICDs in Portugal in 2012, of which 21 were public and five private (eight in the north, three in the central region, 12 in the south and three in Madeira and the Azores), corresponding to 2.4 centers per million population, which is close to the average figure in the EHRA White Book.<sup>1</sup>

The total number of ICDs implanted was 1048, of which 375 were BiV ICD devices. This corresponds to around 100 per million population, also similar to the average figure for 44 countries in the EHRA White Book for 2011, but only half of the average total of ICDs and BiV ICDs implanted in the 18 most developed European countries.<sup>1,6</sup> However, data from EHRA show marked differences between European countries, four of which implant more than 200 ICDs per million population, while the rates in several other countries are less than 10 per million.

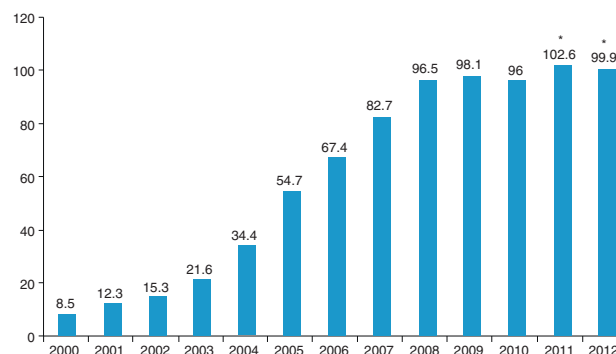
The figures for 2012 reveal a slight fall (3.3%) in the number of first implantations and an increase of 10% in the number of BiV ICDs implanted compared to the previous year. There was, however, a considerable increase in the number of generator replacements, which rose from 202 to 356, resulting in an increase of 3.5% in the total number of implantations in 2012 (Figure 6). In the same year a total of 76 surgical revisions were reported.

Figure 7 shows developments in the annual rate of new ICD implantations (all types, including BiV ICDs) per million population in Portugal; the number has been relatively stable (close to 100 per million population) since 2008.

Figure 8 shows the distribution of first ICD implantations performed by the various centers in 2012, with 80.8% performing  $\geq 10$  implantations per year, and six centers exceeding 50 implantations per year. For this year all centers submitted data on ICDs and BiV ICDs; in 85% of cases a single-chamber system was used.



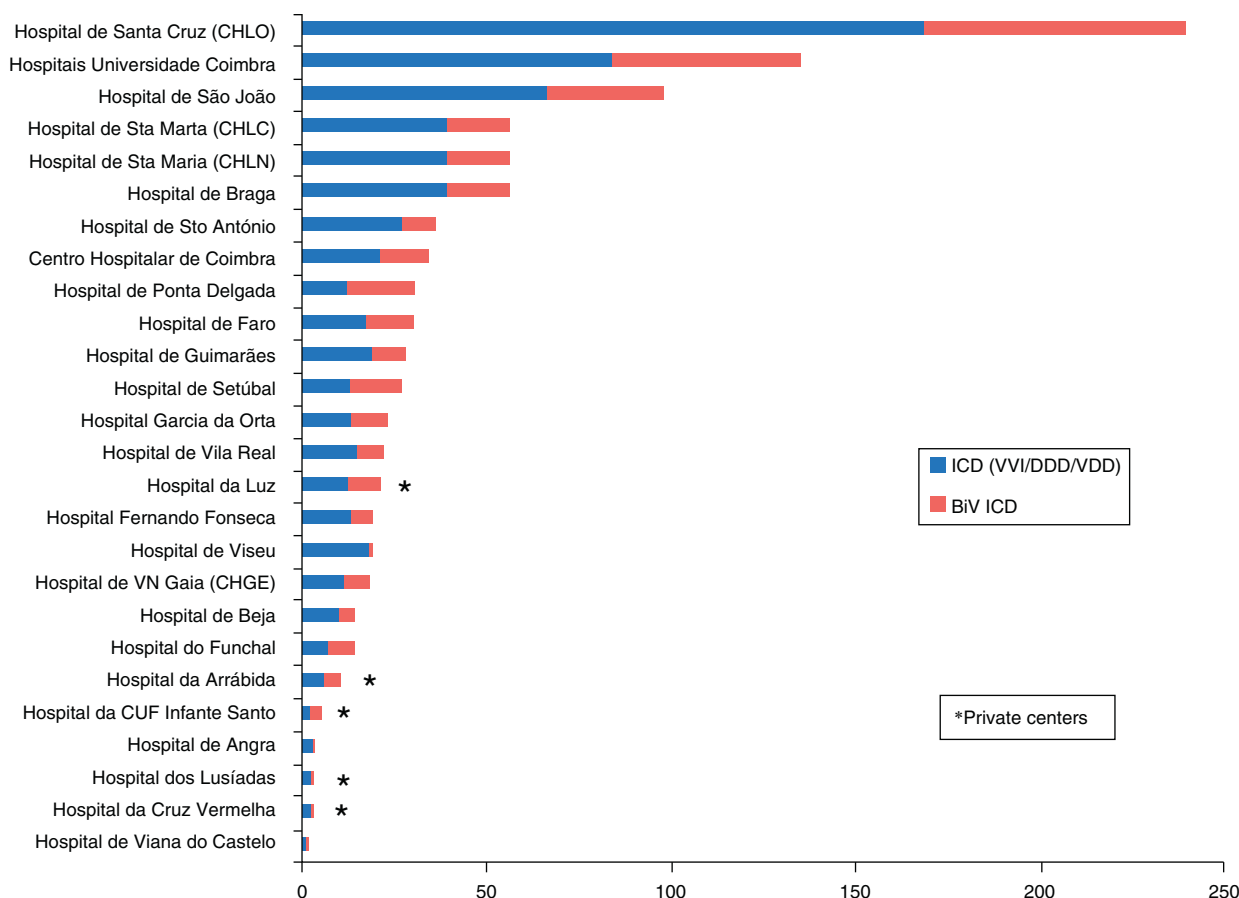
**Figure 6** Number of first implantations of implantable cardioverter-defibrillators and biventricular pacemakers with defibrillator back-up, and generator replacements in Portugal in 2011 and 2012. BiV ICD: biventricular pacemaker with defibrillator back-up; ICD: implantable cardioverter-defibrillator.



**Figure 7** Number of first implantations of implantable cardioverter-defibrillators, including biventricular pacemakers with defibrillator back-up, per million population in Portugal from 2000 to 2012. \*Population resident in Portugal, based on 2011 census and 2012 data from the National Institute of Statistics.

### Discussion and Conclusions

This registry shows that invasive electrophysiology in Portugal is relatively stable in terms of numbers of active centers and of procedures, and that the numbers of AF ablations and BiV ICD implantations has increased, in line with recent changes in international guidelines for the treatment of AF and heart failure.<sup>5,7</sup> One point to note is the continuing heterogeneity in the geographical distribution of centers and the number of ablations performed, with two-thirds of



**Figure 8** Number and type of implantable cardioverter-defibrillators implanted in Portugal in 2012 by center. BiV ICD: biventricular pacemaker with defibrillator back-up; ICD: implantable cardioverter-defibrillator; VVI/DDD/VDD: pacing modes.

centers performing less than 100 ablations per year, which may reflect local difficulties in human and logistical resources, or a saturation point may have been reached in terms of national requirements.

A tendency towards greater complexity of interventions can be seen, which demonstrates that despite the shortfalls in available resources, clinical electrophysiology continues to develop in a variety of ways. It is nevertheless to be hoped that the number of AF ablations per center will continue to increase, seeing that of the 11 centers with facilities for AF ablation, only 45.5% carry out more than 20 ablations per year.

As in previous years, the number of ablations for atrial tachycardia and ventricular tachyarrhythmia remains low (<10% of the total), but with the introduction of three-dimensional mapping systems and improvements in clinical outcomes this is predicted to rise, particularly in patients with ICDs receiving appropriate therapies and those who have undergone AF ablation, in whom recurrent left atrial reentrant tachycardia has been shown to be related to gaps in ablation lines.

A slight increase was seen in the number of atrioventricular junction ablations, which may be due to its growing use in patients with cardiac resynchronization systems and permanent AF that does not respond to pharmacological ventricular rate control.

With regard to training in clinical electrophysiology, the situation improved compared to previous years: in 2012 there were six centers (five public and one private) in the northern, central and southern regions that performed more than 100 ablations per year, which can thus provide the minimum recommended procedural numbers during the two years' training required for the subspecialty of clinical electrophysiology (participation in 150 catheter ablations, 35 of which as the primary operator).<sup>3</sup>

ICD implantations remained stable, while there was an increase of around 10% in first implantations of BiV ICDs. The significant rise in the number of generator replacements resulted in an overall increase of 3.5% in the total number of ICD implantations. Surgical revisions of the pocket accounted for 5.1% of all procedures, compared to 4.5% in the previous year.

Concerning training in device implantation, the European guidelines recommend participation in 30 ICD (15 as the primary operator) and 20 BiV ICD implantations (10 as the primary operator).<sup>3</sup> In 2012, around half of Portuguese centers were able to provide this training experience. Although data are not available on lead extraction, this procedure is increasingly necessary in Europe and must be covered in the training of electrophysiologists.<sup>8</sup>

The economic constraints resulting from the crisis affecting Portugal may have acted as a significant brake on



growth in this important area with well known clinical benefits, despite falls in the cost of ICDs. This situation should be brought to the attention of the health authorities, since the figures for Portugal are still below the European average.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that no patient data appear in this article.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

## Conflicts of interest

The authors have no conflicts of interest to declare.

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